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PATENT APPLICATION  
STANDING ASSIST CANE

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Title: Standing Assist Cane

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## BACKGROUND OF THE INVENTION

5 The present invention relates to devices which assist persons in moving from a sitting to a standing position to a sitting position, and from a sitting position to a standing position. More particularly, the present invention relates to embodiments of a cane having power means for telescoping over a range of lengths. Embodiments of the present invention may be used for assisting the user to either sit or stand using the cane for support, the cane length changing as desired by the user.

## 10 SUMMARY OF THE INVENTION

The present invention is directed to a variable length cane which meets the need identified above.

One embodiment of the disclosed apparatus generally comprises a first member and second member slideably connected to the first member. The first member has a first inside diameter, a first  
15 end, and a second end. The second member has a ground engaging end, an upper end, and an intermediate section between the ground engaging end and the upper end. The upper end of the second member has a second inside diameter. The upper end and a portion of the intermediate section are slideably connected to the first member. A ball screw, having a ball nut threaded thereon, is inserted into the second member. The ball screw also has a top end and a bottom end, the bottom end  
20 inserted into the second member. The ball nut is attached to the second member. This embodiment also comprises power means for rotating the ball screw, where the power means are operably attached to the ball screw, and means for activating the power means. When the power means are activated, the ball screw rotates, causing the ball nut to travel along a portion of the length of the ball screw. Because the ball nut is attached to the second member, the second member moves in combination with the ball  
25 screw. The power means may be attached to the ball screw through a plurality of gears, including a planetary gear arrangement, which may act reduce the rotational speed of the ball screw from the speed of the power means.

These and other features, aspects, and advantages of the present invention will become better

understood with regard to the following description, appended claims, and accompanying drawings.

### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a side view of one embodiment of the disclosed cane.

Fig. 2 is an exploded view of one embodiment of the disclosed cane.

5 Fig. 3 is a side view of a second embodiment of the disclosed cane.

### DETAILED DESCRIPTION OF THE EMBODIMENTS

Referring now specifically to the drawings, Figure 1 shows an embodiment 10 of the disclosed cane in a “retracted” position, that is where the members of the cane are telescoped together to a near  
 10 minimal length. As shown in Figure 1, the major exterior components of this embodiment comprise a first member 12, a second member 14 attached to the first member, the second member having a ground engaging end 16. This embodiment may further comprise a motor housing 18 attached to the first member 12. Handle member 20 may be connected directly to motor housing 18. Alternatively, an enlarged battery housing 22 may be placed between the motor housing 18 and the handle member  
 15 20. However, it is to be appreciated by those knowledgeable in the art that an acceptable battery housing may be placed in many different positions on the cane, depending upon the type and number of batteries. For example, Figure 3 shows an embodiment 10' where the battery housing comprises the handle member 20', in which one or more batteries may be installed lengthwise. Means for activating a motor or other power means may include a switch 23 which is electrically connected to a current  
 20 source, such as a battery.

Figure 2 shows an exploded view of an embodiment 10 of the cane, which shows the internal components of this embodiment. As shown in Figure 2, first member 12 has a first inside diameter  $d_1$ , a first end 24 and a second end 26. Second end 26 may comprise threads (not shown) and a corresponding seal nut 27 to seal the annular opening between first member 12 and second member  
 25 14.

Second member 14 has a ground engaging end 16, an upper end 28, and an intermediate section 30 which is defined as the length of the member between the ground engaging end 16 and the upper end 28. The upper end 28 has a second inside diameter  $d_2$  and an outside diameter  $d_o$ . Ground

engaging end 16 may have a tip 32 which may be added to protect the ground engaging end from wear, to increase the contact area of the bottom of the cane to the ground, to reduce the sound of the cane engaging the ground, and to provide cushioning to the user's arm as the tip 32 makes contact with the ground. For example, tip 32 may comprise a quad-tip as known in the art.

5       The upper end 28 of second member 14 and a portion of the intermediate section 30 are slideably connected to first member 12, to allow the first member and second member to telescope outwardly with respect to one another, or to contract inwardly. This connection may be implemented, as shown in Figure 2, by slideably inserting the upper end 28 and some or all of the intermediate section 30 into the second end 26 of the first member 12. If the first member 12 and second member 14 are  
10       connected in this manner, inside diameter  $d_i$  must be larger than the outside diameter  $d_o$  of the second member.

      The cane further comprises a ball screw 34, which converts rotary motion to linear motion. The ball screw 34 comprises a top end 36 and a bottom end 38. A ball nut 40 is threaded onto the ball screw. A ball screw generally utilizes a number of ball bearings, contained within the ball nut, which  
15       form the interface between the screw and the nut, thereby reducing the friction between the screw and the nut. The ball nut 40 has a series of annular grooves. Within the inside of the ball nut, a ball cage has spaced holes which locate the ball bearings at the intersections of the helical thread on the shaft of the ball screw.

      The ball screw 34 may comprise a first stop pin 42 extending from the surface of the ball screw  
20       adjacent to the top end 36 and a second stop pin 44 extending from the surface of the ball screw adjacent to the bottom end 38. The ball nut 40 may have a tab on either side of it. When the tabs engage a stop pin, the ball cage and ball bearings rotate as unit with the screw, defined as freewheeling. Therefore, the ball nut 40 freewheels upon engaging either the first stop pin 42 or the second stop pin 44. This features prevents the ball nut 40 from continuing to travel down the length of the ball screw  
25       34 while the screw is turning. Therefore, when the cane is extended to its full length, or retracted to its shortest length, the ball nut 40 will stop traveling, even though the power means continues to be engaged, thereby preventing damage to the various mechanisms of the cane. It is to be appreciated that limit switches might be used to accomplish the same purpose as the stop pins 42, 44 and the tabs on the

ball nut 40. While there are several manufacturers of ball screws, acceptable ball screws include the epicyclic models manufactured by Motion Systems Corporation of Eatontown, NJ, including screw part number 21631-060 and nut part number 31214-002.

The bottom end 38 of the ball screw 34 is inserted into the second member 14. The ball nut 40 is attached to the second member 14. For example, the ball nut 40 may be enclosed within a housing 46 having an outer surface, where the outer surface engages the second inside diameter  $d_2$  of the second member 14 by a friction fit. With the ball nut 40 attached to the second member 14, the ball nut and second member move as a unit. As the ball screw 34 is rotated, ball nut 40 will move linearly up or down the ball screw without rotating, and the second member will move with it. The housing 46 may comprise a thermoplastic material, such as DELRIN manufactured by DuPont.

The cane further comprises power means for rotating the ball screw 34. The power means may comprise an electric motor 48 which is operably attached to the ball screw 34. For example, an electric motor 48 may be attached to the ball screw 34 by a plurality of gears, such as a planetary gear train comprising first planetary gear assembly 52 and second planetary gear assembly 54, which are separated by spacer 56 as shown in Figure 2. The planetary gear train might connect to electric motor 48 by a spline gear 60 of first planetary gear assembly 52, which engages a corresponding gear bushing 53 operably connected to electric motor 48. The electric motor may be of the same variety as that used in cordless drills and screwdrivers, such as that found in a DeWalt 7.2 volt pivoting screwdriver, manufactured by Johnson. The electric motor 48 may be held within motor housing 18 by support sleeve 50 which may fit around motor 48, creating a friction fit within the motor housing.

The planetary gear train, or other gear reducers known in the art, acts to convert the rotational speed of the motor to a slower speed being imparted to the ball screw 34. For example, the first planetary gear assembly 52 might have a turndown ratio of four-to-one, and the second planetary gear assembly 54 might also have turndown ratio of four-to-one, resulting in a total gear reduction of sixteen-to-one. It is to be appreciated that any reduction gearing between the power means and the ball screw 34 will impact the linear speed of the ball nut 40 as it traverses the threads of the ball screw. For example, the ball nut might advance an eighth of an inch for each revolution of the ball screw. Therefore, those skilled in the art will be able to adjust how quickly the cane extends or retracts by

adjusting gear ratios between the power means and the ball screw 34. Acceptable planetary gears, and related equipment such as spacers may be obtained from Matex Products, Inc.

The cane further comprises means for activating the power means. For example, if electric motor 48 is used for the power means, the means for activating the motor may comprise switch 23. In this case, a current source, such as battery 58 may be used to operate the motor 48. The switch 23 would then be electrically connected to the current source, the battery 58, and the power means, the motor 48. Switch 23 may be a variable position switch, having at least three positions. The switch may have a first position in which the ball screw 34 rotates in a clockwise direction. The switch may also have a second position where the ball screw rotates in a counter-clockwise direction. The switch might also have a third position where there is no current flow to the motor 48, i.e., an "off" position. Because the travel direction of ball nut 40 depends upon the rotational direction of the ball screw, clockwise rotation will either move the ball nut toward the top end 36 of the ball screw or toward the bottom end 38 and counter-clockwise rotation will move the ball nut in the opposite direction. Therefore, the user of the cane might control whether the cane extends or retracts by manipulation of the switch to either the first position or to the second position. A rocker-type switch might be used, in which the switch is normally in the third or off position, and depressing the top part of the switch causes the cane to extend while depressing the bottom part of the switch causes the cane to retract, or vice-versa.

If a battery 58 is used as the current source, the battery may be rechargeable, the cane may comprise a port 61 for connecting a recharging unit to the battery. While Figure 2 shows the battery located in a battery housing 22 comprising top member 22a and bottom member 22b, it is to be appreciated that the battery or batteries may be located in many different locations in the cane, such as in handle member 20' as shown in Figure 3. One acceptable rechargeable battery is the nickel metal hydride type.

The ball screw 34 may further comprise a spline gear 62 attached to the top end 36 of the ball screw. The spline gear 62 may be supported within first member 12 by a first bearing means, such as one or more ball bearing assemblies 64 and the associated bearing races 66. Spline gear 62 may be secured to the connecting planetary gear 54 by lockring 68. The bottom end 38 of the ball screw 34

may be supported within the second member 14 by a second bearing means, such as clutch bearing 70.

The clutch bearing 70 may be encased within a bearing housing 72, including a housing comprising a thermoplastic material such as DELRIN. The clutch bearing 70 spins freely in one direction but provides resistance in the opposite direction. This feature restricts the cane from contracting or

5 shortening as weight is placed upon the cane

While the above is a description of various embodiments of the present invention, further modifications may be employed without departing from the spirit and scope of the present invention. For example, the size, shape, and/or material of the various components may be changed as desired.

Thus the scope of the invention should not be limited by the specific structures disclosed. Instead the  
10 true scope of the invention should be determined by the following claims.